PATENT SPECIFICATION 1,156,860

DRAWINGS ATTACHED.

1,156,860

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COMPLETE SPECIFICATION.

Process and Apparatus for the Packaging of Panels of Elastic Fibrous or Cellular Material, for example Glass Fibre.

We, COMPAGNIE DE SAINT-GOBAIN, a French body Corporate, of 62, Boulevard Victor-Hugo, Neuilly-sur-Seine, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to porous panels of elastic fibrous or cellular material, particularly to panels of mineral fibre, for example a glass fibre, held together by a binder.

Such panels are particularly used as thermal and/or acoustical insulation and have a loose structure, the fibres occupying a small part of their volume. Thus the volume of the fibres may be of the order of 3% of the total volume of the panel. As a result, such panels are of low density, and are cumbersome. This constitutes a serious drawback for their transport, which greatly increases their price at the place of use, and also for their storage, which requires considerable covered areas. On the other hand, if the panels are transported or stored without being protected, currents of air may circulate in them and these currents may cause convection or produce variations of atmospheric pressure. These currents are harmful to the insulating properties because of the humidity of the ambient air or the presence of dust in ambient air. They are particularly harmful in the case of salty air for example, when the panels are transported by sea, as they cause salt deposit on the fibres, which considerably reduces the insulating properties.

Another disadvantage is that such panels, the fibres of which are level with the surface, are relatively fragile and are easily damaged when stacked.

Further, the intrinsic value of these panels, which is relatively low, does not justify the use of packages constituted by rigid air-tight containers, which would be resistant to the pressure differences due to weather conditions and temperature differences.

An object of the invention is to avoid as far as possible these drawbacks.

The process according to the invention comprises:— placing a porous panel or a stack of porous panels in a flexible envelope or constituent parts of an envelope, while leaving communication between the interior of the latter and atmosphere free; exerting compression perpendicular to the main faces of the panel or stack, so as to reduce the thickness thereof, which pressure is less than the elastic deformation limit of the product; and hermetically sealing the envelope while under compression.

Under these conditions, it is possible to reduce considerably the volume of a panel or stack of panels while making it possible for it or them to return sensibly to the original state when removed from the envelope.

It has been found that after the pressure exerted on the large faces of the panel or stack is released, the product swells again, because of its elasticity, inside the sealed envelope, so that the pressure inside the envelope becomes lower than atmospheric pressure. This swelling continues until there is equilibrium between, on the one hand, the sum of the elastic pressures directed towards the swelling of the product and the air pressure or gas pressure contained

in the envelope which is below atmospheric pressure, and, on the other hand, the external pressure on the envelope, i.e. atmospheric pressure. Once this equilibrium has been reached, what may be termed the stable state of the panel or stack is obtained.

According to an optional feature of the invention, the volume of the envelope is greater than the volume which is capable of taking the panel or stack in its stable state, so that, under atmospheric pressure, the faces of the panel or stack remain flat.

Moreover, it is desirable that the size of the flexible envelope, corresponding to the height of the panel or stack, should be capable of reaching a value which is at least equal to that of the panel or stack when the stable state is achieved. It is even advantageous that the size of this envelope should be clearly greater, which avoids, should air re-enter, any great deformation of the main surfaces of the panel or stack.

The compression exerted can vary within wide limits, according to the characteristics of the panel (density, nature and diameter of the fibres, nature and density of the binder, etc.). As a general rule, in order to obtain a reduction of 50% of the initial thickness, it is sufficient to exert on the large faces of the panels a compression of the order of 0.1 to 0.2 bars.

The compression can also depend to a certain degree on the length of time which the panels are kept in their envelope. On this subject it is necessary to note that a panel of glass fibres, the compression of which is 40% of the initial thickness, acquires after 30 days, about 97% and, after three months, about 95% of this thickness immediately after removal from the envelope.

The envelope can be any flexible impermeable material, for example polyethylene polyvinyl chloride or cellulose acetate.

The panel or stack can be placed in an already-adapted envelope, before or during compression, leaving free communication between the interior of the envelope and atmosphere.

One can also place on each of the main faces of the panel or stack, before compression, a sheet of the material of which the envelope is to be comprised, and, after compression, seal the envelope by joining hermetically the edges of the sheets.

The compression can be carried out by any suitable means, for example between rigid plates, the surfaces of which are greater than those of the main face of the panel or stack, or between convergent conveyor belts.

Below are described, by way of example, embodiments of apparatus in accordance with the invention and with reference to the accompanying drawings, in which:—

Figure 1 is a perspective view of a stack of panels disposed between two plates;

Figure 2 is an elevation at the outset compression;

Figure 3 is an elevation of the final compression and hermetic sealing of the envelope;

Figure 4 is a perspective view of a stack of panels in their package;

Figure 5 is a perspective view, of an apparatus which enables the conditioning operations to be obtained in a continuous cycle; and

Figure 6 is a graph showing curves relating to the return of the thickness of panels conditioned in accordance with the invention, as a function of the length of the conditioning and according to various states of compression.

As can be seen in Figures 1 to 3, it is proposed to encase, with a view to its storing or transport, a stack of panels P between each of which can eventually be interposed a sheet of paper or the like, this stack having a thickness S^1.

Before compression, this stack is placed in an envelope which can be in the form of a bag, and completely or partially open. In the example shown, two sheets M^1 and M^{11} of flexible material are used, which are applied onto the main faces of the stack, the dimensions of these sheets being greater than those of the main faces.

The stack of panels is then subjected to a compression which is uniform and perpendicular to these main faces. Compression is carried out by placing the stack between a fixed plate 11 and a pressure plate 10.

The pile P is compressed until its thickness is reduced to a value S^{11} which is a function of the different factors, to which further reference will be made.

While the stack of panels P is maintained at its reduced thickness S^{11}, the envelope is sealed by welding together the edges of the sheets M^1 and M^{11}, for example by thermal welding.

The welding of the envelope is realised in such a way that, taking into consideration the ultimate elastic swelling of the product, an envelope is obtained with a height that is at least equal to that of the stack of panels when the latter takes on its stable state.

Figure 4 shows a conditioned stack Pc. The thickness of this stack is dS^{11} which is slightly greater than the thickness S^{11} endowed on it during compression and which corresponds to the stable state, the sum of the elastic pressure exerted by the product and the interior pressure of the gas in the envelope being, therefore, equal to the atmospheric pressure shown by a

series of arrows perpendicular to the large faces of the stack.

Figure 5 shows an installation for continuously obtaining packages according to the invention. The panels or stacks of panels P are brought in the direction of the arrow A by a conveyor 20 of any suitable type. They pass between two devices 21 and 22 each delivering a sheet of flexible enveloping material M^1—M^{11}, these sheets covering the main faces of the stack. The stack thus covered with these sheets then passes between the compression apparatus indicated by a pressure plate 10 and plates 23 between the rollers of the conveyor 20.

Devices for folding, sealing and welding the sheets M^1—M^{11} round the compressed stack P^1 are not described or shown; they can be carried out in well known manner.

The conditioned stack Pc is removed in the direction of the arrow A^1.

The curves of Figure 6 are relative to the re-swelling or return to original thickness of the glass fibre panels currently manufactured, after the panels have been removed from their package. The times, expressed in days, during which the panels have remained conditioned, are shown as abscissae, and the percentage of the permanent deformations of the panels, as ordinates. The different curves of this Figure are relative to the different degrees of compression, from 10 to 50%.

These curves make it possible to determine the degree of compression to be exerted on the panels or stacks of panels in order to return to the latter a given percentage of their original thickness after a certain length of time in storage. For example, if 50 days elapse between conditioning and removal from the package, and if the product is to regain 96% at least of its initial thickness, compression should not exceed 40% of this thickness. This compression can be higher if the product is not in its encased state for long, and if a lesser elastic return is tolerated.

It should be noted that the degrees of deformation shown are not rigidly constant, and that the fibrous products, after compression, can in time return to a thickness which is sensibly nearer to its initial thickness than is shown in the graph in Figure 6, where the curves consider the immediate elastic return when the compression is halted.

The hermetic packaging of the products conditioned according to the invention, makes it possible to ensure that the most favourable ambient conditions are maintained in the package. Thus the conditioning installation can be situated in a determined atmosphere, for example in a purified atmosphere with a desired degree of humidity, and/or strongly ionised, or so treated that any actions which would alter the conditioned product are prevented, etc.

WHAT WE CLAIM IS:—

1. A process for packaging a porous panel or a stack of porous panels of cellular or fibrous elastic material, comprising placing the panel or a stack of panels in a flexible envelope or constituent parts for forming an envelope, while leaving communication between the interior of the latter and atmosphere free; exerting compression perpendicular to the main faces of the panel or stack, so as to reduce the thickness thereof, which pressure is less than the elastic deformation limit of the product; and hermetically sealing the envelope while under compression.

2. A process according to claim 1 wherein the envelope is of a volume greater than the volume which the panel or stack is likely to take up inside the closed envelope.

3. A process according to claim 1 or claim 2 wherein the envelope dimension corresponding to the height of the panel or stack is at least equal to that of the height of the panel or stack when the latter has reached its stable state inside the closed envelope.

4. A process according to any preceding claim wherein, on each main face of the panel or stack, is placed a sheet of flexible material, these two sheets constituting all or part of the envelope and, after compression of the whole with the aid of means acting over the whole area of the said main faces, the casing is hermetically sealed while under pressure.

5. Apparatus when used for packaging a panel or a stack of panels according to Claim 1, comprising means for placing the panel or a stack of panels in a flexible envelope or constitutive parts of an envelope, while leaving communication between the interior of the latter and atmosphere free, means for exerting compression perpendicular to the main faces of the panel or stack, so as to reduce the thickness thereof, which pressure is less than the elastic deformation limit of the product; and means for hermetically sealing the envelope while under compression.

6. Apparatus according to Claim 5 when used according to Claim 1, comprising means for delivering sheets of flexible material which are each placed on the main faces prior to compression, and means for welding the sheets to form a hermetically sealed envelope for the panel or stack.

7. A process for packaging a panel or a stack of panels, substantially as herein

described, with reference to the accompanying drawings.

8. Apparatus for packaging a panel, or a stack when used substantially as herein described, with reference to the accompanying drawings.

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2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

FIG. 1.

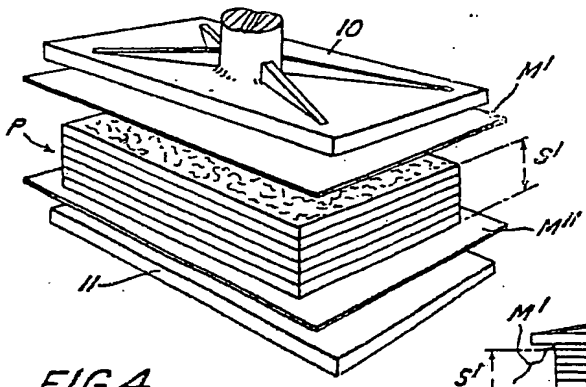


FIG. 2.

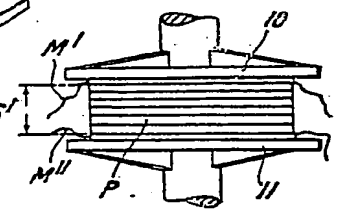
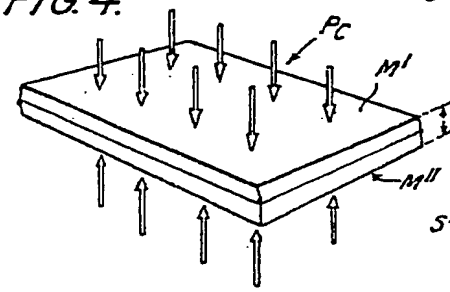


FIG. 4.



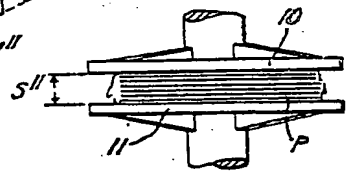
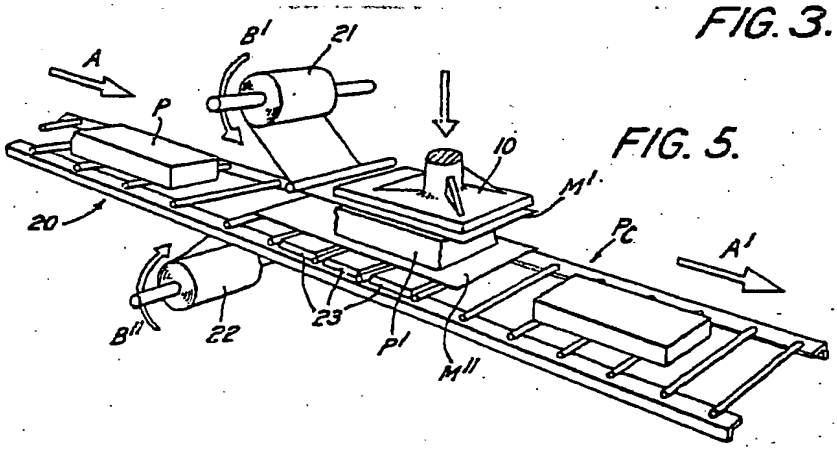


FIG. 3.

FIG. 5.



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Sheet 2

FIG. 6.